

*City planning
Energy related Earthquakes**Oakdale*

The Water, Geology, and Seismic Safety Element "consists of an identification of seismic hazards such as susceptibility to surface ruptures from faulting, to ground shaking, to ground failure, or to efforts of seismically induced waves such as tsunami and seiches."

Additionally, this element speaks to the delicate water balance operating in the Central Valley which is of equal or greater import to the seismic potential of the area.

Commonly Used Terms

Active Fault: A fault that has moved in recent geologic time and which is likely to move again in the relatively near future.

Alluvial Cone (or fan): A cone-shaped deposit of alluvium made by a swift stream where it runs out into a level plain or meets a slower stream.

Alluvium: Sand, clay, etc., deposited by flowing water, especially along a river bed.

Earthquake: A shaking or trembling of the crust of the earth, caused by underground volcanic forces or by breaking and shifting of rock beneath the surface.

Erosion Activity: A reflection of the estimated rate at which soil is being eroded naturally from undisturbed areas. Estimated rates of erosion activity are based primarily on interpretation of soil survey data, including characteristics of the soil profile, slope angle, and degree of protection from vegetation.

Fault: A plane or surface in earth materials along which failure has occurred and materials on opposite sides have moved relative to one another in response to accumulation of stress in the rocks.

Ground water: Water found underground in porous rock strata and soils, as in a spring.

Inactive Fault: A fault which shows no evidence of movement in recent geologic time and no evidence of potential.

Seiches: Earthquake induced waves in lakes or ponds.

Seismic: Pertaining to or caused by an earthquake.

Tsunami: Earthquake induced ocean waves, commonly referred to as tidal waves.

I. WATER

As regards ground water and geologic research, most recent data available comes from a study made by the United States Department of the Interior Bureau of Reclamation. The study was undertaken to "assist in determining the amount of surface water required by the combined districts under operation of the proposed New Melones Dam in exchange for their water rights from Melones Reservoir."

The following basic data was outlined in the report.

"The average depth of water in South San Joaquin I.D. as of spring 1972 was about 25 feet, ranging from 8 feet on the southwest to 50 feet on the northeast. The average depth to water in the Oakdale I.D. as of spring 1972 was about 70 feet, ranging from about 50 feet on the west to about 100 feet near Oakdale. Ground-water movement trends northwestward toward the pumping cone of depression beneath Stockton with an average gradient of about 12 feet per mile, as shown on the ground-water elevation contour map for spring 1968 (map 5 of following maps). Ground-water also moves westward toward the San Joaquin River and southward toward the Stanislaus River. Ground-water moves generally southwestward from the Oakdale I.D. portion of the study area."

The Department of Interior report made the following recommendations, with which the City should take note.

"The safe ground-water supply (pumpage) in the study area has been estimated to be 110,000 acre-feet per year under present and ultimate land use."

The report indicated that "ground-water pumpage should not exceed about 110,000 acre-feet for the following reasons

1. In the 1957 Folsom South Study, subinflow from the subject study area was included in the recharge to that ground-water reservoir. Therefore, any increase in pumpage over 110,000 acre-feet safe yield would decrease the safe ground-water supply in the Folsom South service area. Other contiguous areas would also experience a decrease in recharge if pumpage exceeded safe ground-water supply. It is reported in State of California DWR Bulletin 21-64 in Table I that the two districts pumped almost 80,000 acre-feet in 1964 for irrigation and domestic use from wells (drainage pumpage is reported separately).

The New Melones project will include a 625 foot high earth and rockfill structure with a crest elevation of 1,135.5 feet. The Environmental Impact Study for the project reveals that:

"...the project area has experienced little seismic activity in historical times. The nearest known active fault is the Owens Valley Fault about 70 miles east of the project. The New Melones Lake site is subject to tremors from frequent earthquakes of relatively small magnitude having epicenters within 150 miles of the site. No data is available on intensity of these tremors at the site. A program has been established for seismic monitoring of the project area before, during and after construction of New Melones Dam."

A geologic study of the area prepared by the geologic consulting firm of Woodward-Lundgren and Associates reveals that:

"...based on the available data there is no evidence that these faults are active, but insufficient work has been done to conclude that they are inactive. Their apparent seismic quiescence may merely indicate that the recurrence interval of earthquake activity is very long. Damaging earthquakes, such as the San Fernando Earthquake, have originated on faults which, due to lack of knowledge or detailed investigation, were previously assumed to be inactive. Moreover, impoundment of large reservoirs sometimes creates the special problem of reactivation of faults presumed to be 'dead.'"

The report goes on to indicate that there has been seismic activity associated with the faults which run through the Melones area.

To underscore the importance of this type of activity, the geologist indicated:

"...the subject of local earthquakes is important because impoundment of deep reservoirs behind large dams has been known to trigger destructive earthquakes in regions previously believed to be seismically quiet. The earthquakes which followed filling of reservoirs behind Koyna Dam in India, Lremasta Dam in Greece, and Kariba Dam in Rhodesia are of particular interest in this regard because these sites had presumably inactive faults or shear zones passing through or near them..."

2. Increased pumpage would lower water levels, possibly create an overdraft, increase pumping costs, and could affect surface and ground-water quality."

Speaking to the implications of Modesto's increased use of ground water, the California Department of Water Resources indicates that "Because ground-water movement in (our) area is from east to west, and replenishment of Oakdale's supply is in large part accomplished by distribution of irrigation supplies over the area by Oakdale Irrigation District, the department would not expect use of ground water by Modesto to have any adverse effect on the ground-water supply for Oakdale." However, increased pumpage by Stockton may have an impact on Oakdale's ground-water supply. Thus, the City should take appropriate steps to monitor ground-water pumpage by the City of Stockton.

The entire subject of water management is complex and beyond the scope of this element to explain. Rather, it suffices to indicate that we are dealing with a complex circulation system. The City will need to be vigilant in the years to come if it is to preserve its water resources.

II. GEOLOGY AND SEISMIC SAFETY

Information obtained from the California Division of Mines and Geology reveals that: (1) the Stanislaus River is a natural area of flooding; (2) if an earthquake occurs it will be low in severity causing minor to moderate damage; (3) Oakdale lies in an area where there is low erosion activity; and (4) the relative number of landslides is nil.

Pliocene and Pleistocene Nonmarine Sedimentary deposits - 5,000 to 7,000,000 years old are found in the Oakdale area. Other formations found in Oakdale include recent river and major stream channel deposits and recent alluvial fan deposits.

There are three fault zones to the north of Oakdale, the Melones Fault Zone, the Bostic Fault Zone, and the Bear Mountain Fault Zone. These faults are considered to be inactive by some geologists. However, there is much debate among geologists as to what constitutes an inactive fault.

The Oakdale community has not experienced serious damage due to past earthquake activity, however, Modesto suffered serious damage due to the earthquake which caused so much damage to San Francisco at the turn of the century. Available data on the filling of dams suggests that there is reason to expect a potential danger of dam cleavage, siches, and attending flooding from potential earthquakes along the Melones, Bostic, and Bear Mountain faults. Seismic activity in the Melones area could have serious repercussions for the City of Oakdale. The City should thoroughly assess the situation and potential for disaster.

In order to protect the Oakdale community from water, geologic, and seismic hazards the following goals, objectives, and policies are recommended.

GOALS: WHAT DOES OAKDALE WANT?

- 1.0 To protect the Oakdale community from flooding.
- 2.0 To protect the Oakdale community from geologic hazards.
- 3.0 To protect and insure Oakdale's water quantity and quality along the Stanislaus River, surface water, and ground water.

The following objectives and policies are designed to achieve the above indicated goals of the Water, Geology, and Seismic Safety Element.

OBJECTIVES: WHAT MUST OAKDALE DO?

- 1.0 Guard against development on geologically hazardous areas.

POLICIES: HOW CAN OAKDALE DO THIS?

- 1.1 Develop a flood-plain zone for those areas inundated in the 1955 flood (through "F" zone).
- 1.2 Encourage development on geologically stable soil.
- 1.3 Soils maps should be used in evaluating the potential use of land resources.
- 1.4 Regulate development for residential, commercial, or industrial use within the identified flood-plain.
- 1.5 Coordinate planning efforts between other governmental agencies to determine the potential inundation plain boundaries caused by New Melones Dam leakage and/or fracturing.
- 1.6 Identify appropriate mitigation measures to deal with a major leakage from the Melones Dam.
- 2.0 Maintain "awareness" of seismic activity to provide for the safety of the Oakdale area.
 - 2.1 Study new data as it relates to seismic activity that could affect the Oakdale area.
 - 2.2 Enforce safe building standards.
- 3.0 Take emergency action to save lives and property during or immediately following any particularly disastrous event.
 - 3.1 Develop, maintain, and implement an up to date emergency plan designed to deal with and protect the community from geologic, seismic, and flood hazards.
 - 3.2 Communicate the emergency plan to the people, and schedule a disaster readiness test on an annual basis.

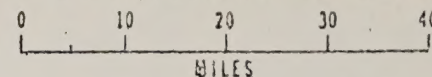
4.0 Insure high standards of water quality and quantity.

- 4.1 Study and evaluate the existing and projected water quality and quantity available to the City through 1995.
- 4.2 Adopt appropriate mitigation measures to insure the highest water quality possible.
- 4.3 Coordinate the City's water management effort with the Oakdale Irrigation District.
- 4.4 Develop an action program to deal with indicated contingencies threatening the quantity and/or quality of Oakdale's water.

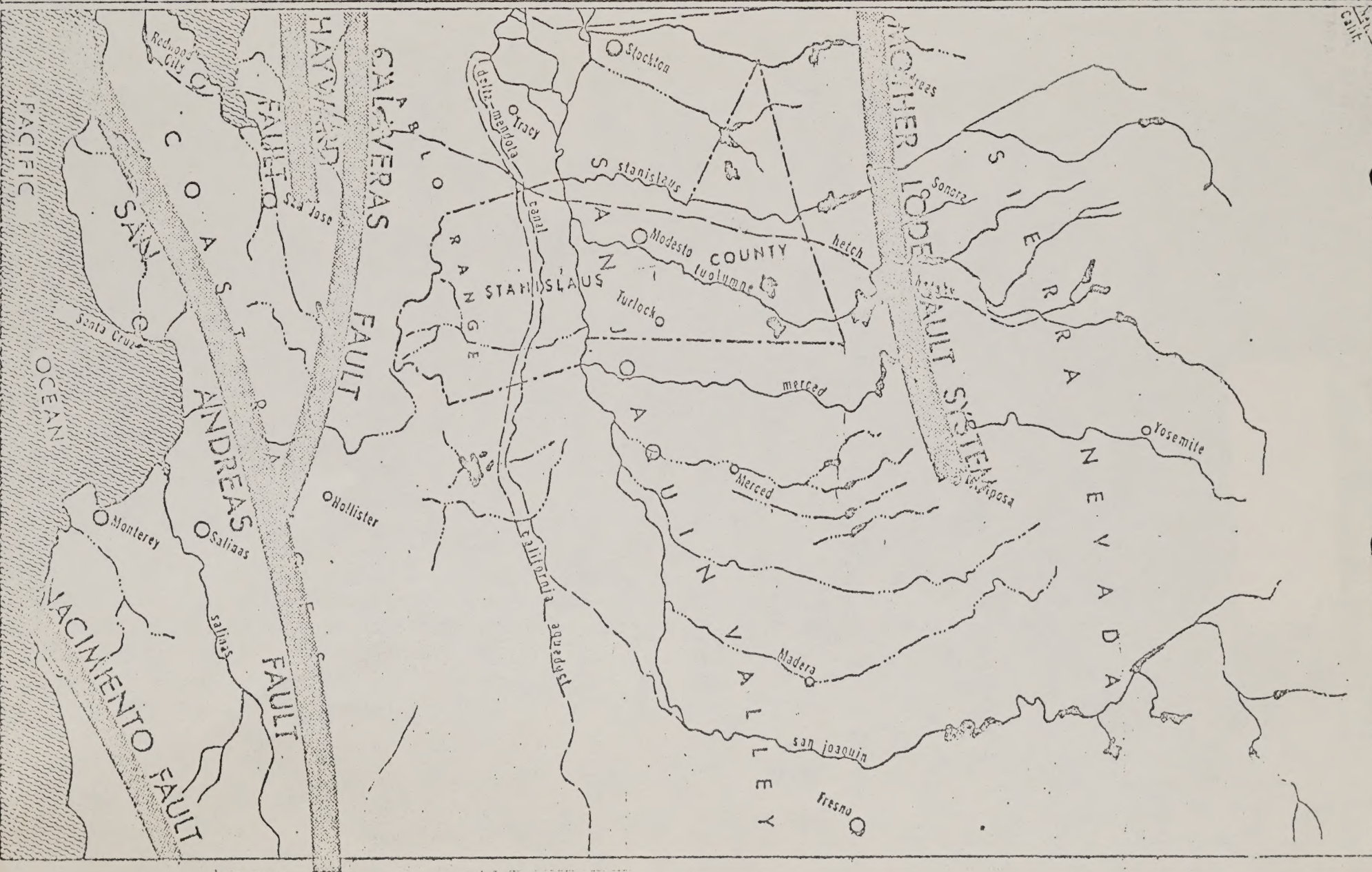
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